

# Parasites in 30 Captive Tokay Geckos, *Gekko gecko*

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**ABSTRACT:** Twelve species of parasites were recovered from recently imported Tokay geckos, *Gekko gecko*. These included one cestode species, *Oochoristica rachiensis*, two trematode species, *Mesocoelium monas* and *Paradistomum geckonum*, six nematode species, *Pharyngodon kuntzi*, *Skrjabinodon* sp., *Parapharyngodon* sp., *Meteterakis longispiculata*, *Physalopteroides* sp., and *Strongyloides* sp., one acanthocephalan species, *Porrorchis* sp., one pentastomid species, *Raillietiella affinis*, and one coccidian species, *Eimeria tokayae*. Of the 20 species previously reported infecting Tokay geckos, eight were identified in this study. Two species are new host records and two others are undescribed species. The most common helminths recovered were *Pharyngodon kuntzi*, *Meteterakis longispiculata*, and *Raillietiella affinis*.

**KEYWORDS:** Tokay gecko, *Gekko gecko*, *Pharyngodon*, *Meteterakis*, *Raillietiella*, parasites.

## INTRODUCTION

In 1998, 1,185,910 lizards were imported into the United States (APHIS, 2001). Tokay geckos, *Gekko gecko*, have been imported for many years in the pet-trade, from eastern Asia. Tokay geckos are found in private collections, in zoos, and in aviaries. They are also a popular model in medical herpetology. Their prey items consist of small mice, insects, and other lizards, which make them a useful method of pest control. However, these wild-caught geckos are brought into the United States potentially containing many different species of parasites (Table 1).

The purpose of this study was to identify parasites of imported and in captive Tokay geckos. Potentially some of these parasites could be transmitted to other species of geckos or reptiles in collections, and possibly to wild endemic populations of reptiles.

## MATERIALS AND METHODS

Thirty geckos were obtained from the Brookfield Zoo, Chicago, IL (n=8) and from reptile importers in southern Florida (n=22). The specimens from the Brookfield Zoo's Reptile House were from an established captive population of Tokay geckos which originated from a wild-caught population. These geckos were previously used as a means of pest control in the building. The geckos were euthanized with a pentobarbital overdose. Each lizard was measured from snout to vent and the gender was determined. Organs were separated from each other and each was placed in a small Petri

dishes containing water. The esophagus, stomach, small and large intestine were slit open, while the heart, lung, trachea, liver/gallbladder were macerated separately. Each dish was examined under a dissecting microscope at 15 times magnification. The coelomic cavity and muscles were also examined grossly. Fecal samples, when present, were collected. Fecal floatations were performed using a saturated sucrose solution. Sedimentation tests were also performed.

Nematodes were fixed in 70% ethanol with glycerin, and then mounted and cleared in lactophenol<sup>a</sup>. Pentastomes were placed in 70% ethanol, and trematodes and cestodes were placed in acetic acid/formalin/alcohol (AFA)<sup>b</sup>. Coccidia were sporulated in 3% potassium dichromate<sup>c</sup>. Trematodes and cestodes were stained with Harris' hematoxylin<sup>d</sup>, dehydrated using increasing concentrations of ethanol, cleared in xylene, and mounted in Canadian Balsam<sup>e</sup>.

## RESULTS

Twelve species of parasites were recovered from 29 Tokay geckos examined in this study. Only one gecko was free of parasites. The 12 species from the wild-caught sample was as follows: one cestode, *Oochoristica karachiensis*; two trematodes, *Mesocoelium sociale* and *Paradistomum geckonum*; six nematodes, *Pharyngodon kuntzi*, *Meteterakis longispiculata*, *Physalopteroides* sp., *Skrjabinodon* sp., *Parapharyngodon* sp., and *Strongyloides* sp.; one acanthocephalan, *Porrorchis* sp.; one pentastomid, *Raillietiella affinis*; and one coccidian, *Eimeria tokayae*. Parasites recovered from the captive Tokay geckos included: four nematodes, *Paradistomum geckonum*,

**Table 1.** Parasites reported in Tokay geckos, *Gekko gekko*.  
\*These authors only identified their lizards to the genus *Gekko*.

Class	Species	Country of Record	Reference
Cestode:	<i>Oochoristica</i> sp.	Kansas City Zoo	Brannian and Greve, 1987
Trematode:	<i>Mesocoelium sociale</i>	Java, Indonesia	Beverley-Burton and Killick, 1982
	<i>Paradistomum geckonum</i>	Java, Indonesia	Beverley-Burton, Killick, Kennedy, 1987
	<i>Postorchigenes majeedi</i>	Laos	Scholz and Ditrach, 1991
	<i>Postorchigenes ovatus</i>	Java, Indonesia	Beverley-Burton and Killick, 1982
Nematode:	<i>Parathelandros orientalis</i>	Fujian, China	Wang P-Q, 1980
	<i>Pharyngodon gekkinis</i>	Canton, China	Liu CK, Wu HW, 1941
	<i>Pharyngodon gekko</i>	India	Chakravarty, Bhaduri, 1948, Baker, 1987
	<i>Pharyngodon kuntzi</i>	Indonesia	Gupta, 1959, Pinnell and Schmidt, 1977
	<i>Physalopteroides geckonis</i>	Pakistan	Bilqees and Siddiqui, 1975*; Brannian and Greve, 1987
	<i>Rhabdias</i> spp.	Indonesia	Pinnell and Schmidt, 1977
	<i>Skrjabinodon apapillosus</i>	Philippines	Koo, 1938, Schmidt and Kuntz, 1972
	<i>Thelandros</i> sp.	Pakistan	Gupta, 1959
	<i>Meteterakis longispiculata</i>	Java	Inglis, 1958
	<i>Thubunaea</i> sp.	Philippines	Schmidt and Kuntz, 1972
Pentastomid:	<i>Raillietiella affinis</i>	Java, Indonesia	Ali, <i>et. al</i> , 1982
	<i>Raillietiella frenatus</i>	South East Asia, Indonesia	Ali and Riley, 1983
	<i>Raillietiella gehyrae</i>	Java, Malaysia	Ali and Riley, 1983
Coccidia:	<i>Eimeria tokayae</i>	South China	Ball and Daszak, 1995
	<i>Eimeria bongonensis</i>	India	Sinha and Sinha, 1981

*Pharyngodon kuntzi*, *Parapharyngodon* sp., *Strongyloides* sp., and one pentastomid, *Raillietiella affinis*. The species, prevalence, intensity, and location in the host are listed, for each parasite, in Table 2. Of the 20 species previously reported from Tokay geckos, eight were found in this study. Two parasite species are new host records and two others are thought to be previously undescribed species.

## DISCUSSION

Imported Tokay geckos may be infected with parasites capable of maintaining their life cycles in captivity. However, several are restricted to the availability of appropriate intermediate hosts. The capability of causing illness can be increased when animals are placed in captivity. The lack of host specificity for some of these parasites leads to the potential for transmission of infection among species in a collection.

The parasite life cycle determines their transmission potential outside the natural home range of the host. Parasites with a direct life cycle do not need an intermediate host to complete their life cycle to become established in captivity. These parasites are more of a concern in infecting other animals in a collection or endemic wildlife. Parasites with an indirect life cycle must have at least one susceptible intermediate host in close proximity to complete their life cycle. Many of these parasites are thought to use a specific intermediate host; however, if a suitable intermediate host is present in the new environment, they could potentially complete their life cycle.

The prevalence of *Paradistomum geckonum* in this study was lower than the 25% reported by (Kennedy, *et al*, 1987), who examined 16 *G. gekko* from their natural habitats in Indonesia. *Paradistomum geckonum* was first described by Bhalerao (1929), and was first reported in the Tokay gecko and re-described by Killick and Beverley-Burton (1982). Several species of reptiles act as hosts for *P. geckonum*, including: the common house gecko, *Hemidactylus frenatus*, the Asian house gecko, *Cosymbotus platyurus*, the stump-toed dtella, *Gehyra mutilata*, the variable agama, *Calotes versicolor*, the Asian grass lizard, *Takydromus sexlineatus*, and the East Indian brown mabuya, *Mabuya multifasciata*. *Paradistomum geckonum* is a member of the family Dicrocoeliidae whose species usually use two intermediate hosts. The capability of this trematode to complete its life cycle outside its geographic range is possible; however, this would require the proper intermediate host within the enclosure. The source of the infection for the captive gecko is not known.

*Mesocoelium monas* (synonym *M. sociale*) was reported by Kennedy, *et al*, (1987) to have a higher prevalence in *G. gekko* in nature, 12.5%, compared to 3% in our study. Luhe (1901) first described *M. monas* (as *M. sociale*), while Killick and Beverley-Burton (1982) re-described and reported the Tokay gecko as a host. Kennedy, *et al*, (1987) stated, "*Lamellaxis gracilis* was found to serve as both the first and second natural intermediate host in the life cycle of the species." This trematode could also potentially infect animals outside its endemic range; however, a suitable mollusc host

**Table 2.** Species, Prevalence, and Intensity of parasites identified in Tokay geckos, *Gekko gecko*. (‡) Undescribed species (±) New host.

Helminth	Prevalence		Intensity		Location
	Number Infected	Percent Infected	Mean	Range	
Trematoda					
<i>Mesocoelium sociale</i>	1	3%	1	1	Small Intestine
<i>Paradistomum geckonum</i>	2	7%	1	1	Gallbladder
Cestoda					
<i>Oochoristica karachiensis</i>	1	3%	1	1	Small Intestine
Nematoda					
<i>Pharyngodon kuntzi</i>	20	67%	92.6	1–334	Small Intestine; Large Intestine
<i>Physalopteroides</i> sp. ‡	6	20%	5.2	2–10	Stomach; Proximal Small Intestine
<i>Skrjabinodon</i> sp.	1	3%	1	1	Large Intestine
<i>Parapharyngodon</i> sp. ‡	5	17%	6.8	2–15	Large Intestine
<i>Meteterakis longispiculata</i>	9	30%	3.9	1–11	Small Intestine; Large Intestine
<i>Strongyloides</i> sp. ±	3	10%	28	1–82	Small Intestine; Large Intestine
Acanthocephala					
<i>Porrorchis</i> sp. ±	1	3%	1	1	Coelomic Cavity Wall
Pentastoma					
<i>Raillietiella affinis</i>	14	47%	7.8	1–33	Lungs
Coccidia					
<i>Eimeria tokayae</i>	2	7%	–	–	Feces

would have to be present within the animal's habitation. *Mesocoelium monas* also lacks host specificity as adults, with reported infections in approximately 110 reptiles and amphibians. Praziquantel 7.5 mg/kg PO is the recommended treatment for either of these trematodes (Plumb, 2002).

Brannian and Greve (1987) found an *Oochoristica* sp. in geckos from the Kansas City Zoo. The species was not determined in their study. The species found in our study, *Oochoristica karachiensis*, was first described as *Diochetos karachiensis* (Bilqees and Siddiqui, 1975). It is in the Order Cyclophyllidae and the life cycle is not known. An arthropod is likely to be an intermediate host. Effective methods of treatment for infection are Fenbendazole 50 mg/kg (PO) or praziquantel 7.5 mg/kg (PO) (Plumb, 2002).

The oxyurids found in this study, *Pharyngodon kuntzi*, *Skrjabinodon* sp., and *Parapharyngodon* sp., are believed to be nonpathogenic. Oxyurids have been considered to have a commensal relationship with their host. Their life cycles are direct, which means the eggs shed in the feces will result in the production of infective larvae which will be eaten by the host. An intermediate host is not needed. Treatment for infections with these species is not considered necessary.

The *Physalopteroides* sp. recovered in the geckos were found encysted in the mucosa of the stomach and in the lumen; however, these organs did not appear to have gross pathologic changes. *Physalopteroides geckonis* was described

from Tokay geckos (Bilqees and Siddiqui, 1975), and later recovered from Tokay geckos from a walk-through exhibit at the Kansas City Zoo (Brannian and Greve, 1987). Brannian and Greve (1987) also reported little evidence of disease associated with the infection. Life cycles of the Spiruroidea are very similar. The eggs are shed with a fully developed L1, which is ingested by an insect and hatches. When the insect is eaten, the L1 undergoes two molts to the infective L3 (Anderson, 2000). Rocca (1993) suggested that the prevalence of encysted nematodes in a lizard population indicates their degree of importance as prey, which would make these lizards intermediate or paratenic hosts. Ivermectin could be considered for treatment of this infection.

One member of the Heterakoidea was identified in this study, *Meteterakis longispiculata*. *Meteterakis longispiculata* was first described from Tokay geckos in Samarang, Java (Baylis, 1929). Little information on the life cycle has been reported. However, members of the superfamily Heterakoidea have direct life cycles (Anderson, 2000). Treatment for infections with this species should be considered. Anthelmintics with possible efficacy are fenbendazole 50 mg/kg (PO) (Plumb, 2002) or ivermectin 0.2 mg/kg (IM or PO) (Plumb, 2002).

The Acanthocephalan found in this study is thought to be a member of the genus *Porrorchis* and this is considered to be a new host record. Acanthocephalans have been reported in

chelonians and snakes. There are no known effective anthelmintics against these helminths.

The pentastomids, *Raillietiella gehyrae*, *R. frenatus*, and *R. affinis* have been reported previously to infect Tokay geckos. A cephalobaenid pentastomid, *R. affinis* has blunt-tipped posterior hooks, and was originally described from *Gekko gecko* by Bovien (1927), Ali, *et al* (1982). Hook measurements were described by Ali, *et al* (1981), to aid in identification. Ali and Riley (1983) experimentally demonstrated that *R. frenatus* and *R. gehyrae* were capable of using cockroaches as intermediate hosts. Although the life cycle for *R. affinis* has not been studied, the life cycle of pentastomids involves two hosts; infections occurs with the ingestion of infected intermediate hosts (Ali and Riley, 1983). Enclosures where insect control is difficult could lead to the possibility of this species completing its life cycle with a suitable intermediate host. "Pentastomid infections may be asymptomatic with little inflammatory response, but in other instances, there may be significant damage and destruction of tissue of the host" (Lane and Mader, 1996). Boyce, *et al*, (1984) reported the mortality of captive American alligator, *Alligator mississippiensis*, hatchlings due to pentastomiasis (*Sebekia oxycephala*). Currently therapy for treatment of pentastomid infection is not available. This genus has not been reported to have zoonotic potential; however, other pentastomes have been reported as zoonotic.

Two species of coccidia have been reported from Tokay geckos, *Eimeria tokayae* and *Eimeria bongonensis*. *Eimeria* species are potential pathogens (Lane and Mader, 1996). Ball and Daszak (1995) first described *E. tokayae*. Species of *Eimeria* have direct life cycles, oocysts are shed in the feces, and the infective oocysts containing sporozoites are ingested resulting in infection. Good hygiene and isolation procedures are important in controlling and preventing coccidiosis in captive reptiles (Lane and Mader, 1996). One treatment for coccidiosis is recommended by trimethoprim sulfadiazine at 30 mg/kg intramuscularly (IM) once daily for 2 days, and then 15 mg/kg IM every 48 hr for five treatments may be used for treatment (Lane and Mader, 1996). Alternatively, sulfadimethoxine, at a loading dose of 90 mg/kg, followed by 45 mg/kg daily for five days may be used via a stomach tube or injecting prey items (Jacobson, 1988).

The majority of parasites recovered from these Tokay geckos have not been reported to cause disease. Very few reports exist on the prevalence and intensity of infection for most of the parasites recovered. This makes correlating infections with illness difficult to determine; however, with increasing data, these correlations may be made in the future.

- a – Melted phenol crystals 1 part, glycerin 2 parts, lactic acid 1 part, 2 parts distilled water.
- b – Stock formalin 100 ml, 85% ethanol 950 ml, stock glacial acetic acid 50 ml
- c – 3 g potassium dichromate, 97 ml water
- d – Fisher Scientific, Pittsburg, PA
- e – Fisher Scientific, Pittsburg, PA

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